International combined transport in Liestal, Switzerland. 7 July 2020. Photo George Raymond.

Visibility for European combined transport

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1 Introduction

Supply-chain visibility providers and the European combined-transport sector need to combine their strengths.

In a world ever more beset with uncertainties, rapid change and bad surprises, companies increasingly require real-time information on the location, status and expected arrival of every shipment in their supply chain. Supply-chain visibility providers (SCVPs) have emerged to meet this need.

In Europe, an important tenet of EU and countries' transport policy is promotion of combined transport (CT), which is also known as intermodal transport. The policy's objective is a shift from all-road freight transport towards CT to help reduce CO_2 and other emissions, energy use, road congestion and accidents.

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In this report, we will focus on *road-rail combined transport*, in which a loading unit such as a container or truck trailer typically moves from the sending customer by road to a CT terminal that loads it onto a train. The train then carries the loading unit hundreds of kilometres to another CT terminal, from where it again moves by road to the receiving customer for unloading. In European regions with waterways, CT also makes much use of barges.

CT is a centrepiece of European transport policy. But a major brake on increasing the modal share of European road-rail CT has been the difficulty of providing industrial customers with the real-time information on the location, status and expected arrival time of their shipments that they need throughout their supply chain. Such information is generally easier to obtain for air, ocean and all-road shipments.

Several factors complexify the provision of shipment information in European road-rail CT. First, despite the European Commission's many years of effort in favour of a Single European Railway Space, in many small but critical ways the continent's railway system remains fragmented by country. This impacts the two-thirds of road-rail CT services that cross borders. Second, a CT shipment often relies on multiple operators of trains, terminals and rail infrastructure. These parties often do not always share the same perceptions and policies on passing shipment information to SCVPs. One difficulty is that although an SCVP may represent the shipper who is ultimately paying for a shipment, the SCVP is not a direct customer of the operator.

Conscious of these difficulties, in recent years the European CT sector has made great strides in standardizing data and messages formats, harmonizing processes, creating reference databases and facilitating data exchange among all involved parties.

This report shows how an SCVP can better integrate data on European combined-transport services, particularly tracking data and ETAs. It shows a way forward for the SCVP – and the challenges it may face and questions it must ask.

1.1 Structure of this report

Starting with the overview in chapter 2, this report presents combined-transport basics in chapter 3, CT's market performance in chapter 4, CT's role in meeting EU goals in chapter 5, information needs in CT in chapter 6 and the CT sector's response to these needs in chapter 0. This response includes the EDICT project, data exchange formats, code registers and reference databases, applications for CT data exchange and a collaborative quality management system. Chapter 8 presents reports from two major CT terminals and chapter 9 an approach for an SCVP seeking to access CT data, challenges it may face and questions it should ask. The report presents its conclusions in chapter 10 and the author in chapter 11.

1.2 Basis for this report

This report is based the author's broad knowledge of European railways and combined transport, supplemented by online and on-site research and information from the UIRR event on the EDICT project on 10 May 2023 at the Transport Logistic trade show in Munich and UIRR's annual report for 2022-2023 distributed on 12 July 2023. An update is forthcoming.

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Tri-modal (Rhine, rail, truck) Swissterminal facility in Basel's Kleinhüningen district. The Rhine waterway system directly serves the five countries whose flags are visible. 19 September 2023. Photo George Raymond.

3 Basics in European combined transport

This chapter presents some basics in European combined transport, including key terms (section 3.1), the central role of UIRR (section 3.1), the separation of trains and infrastructure in Europe (section 3.2) and loading units in combined transport (section 3.3).

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3.1 Some key terms

Like all areas of life, European combined transport has its own very useful terminology and abbreviations. Here are some key terms.

Term	Meaning in the context of European combined transport
CESAR	Co-operative European System for Advanced information Redistribution. Began operation in 2003.
CESAR-NEXT	An IT platform supporting a new generation of CESAR functionality. Began commercial operation on 2 May 2023.
CIS	CESAR Information System, the company that operates CESAR and now CESAR-NEXT.
Consignment	For UIRR, a consignment generally corresponds to the transport capacity of one semi-trailer or two TEUs.
cQMS	Collaborative quality management system for combined transport; formerly called *Q-ELETA.*
cranable semi-trailer	A semi-trailer whose reinforcement enables a gantry or mobile crane (reachstacker) in a CT terminal to lift it when loading or unloading a wagon. Various technologies (including cranable baskets and movable wagon floors) are now being implemented to enable CT terminals to also handle the roughly 90% of European semi-trailers that are non-cranable.
CT: combined transport	A specific case of *intermodal transport.* In combined transport, a loading unit moves over long distances on a rail wagon (or a barge) between terminals. Initial pickup and final delivery is typically over short distances by truck. If the CT terminal is at a port, the port's handling equipment may move the LU to or from a ship.
Customer	For the purposes of this report, any entity that uses and pays for CT, including industrial firms, freight forwarders and logistic service providers.
DCSA	Digital Container Shipment Association, which has developed data exchange standards for the maritime shipping of containers.
DXI	The start-up company that has developed the KV4.0 Data Hub for CT data exchange.

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Term	Meaning in the context of European combined transport
EDICT	Enhanced Data Interoperability for Combined Transport, a two-year, EU-funded project running to September 2024.
eFTI: Electronic Freight Transport Information	EU regulation covering data exchange in all freight modes.
ELETA	Electronic exchange of estimated time of arrival, a project coordinated by UIRR and the Dutch KNV transport agency that ended in 2019 but led to the Q-ELETA project now called cQMS.
ERA	European Union Agency for Railways, a public body that oversees development and application of TAF TSI data-exchange and other railway standards.
ETA: estimated time of arrival	According to the context, this may refer (for exto the time at which a train or a loading unit arrives at a terminal or the loading unit arrives at the destination customer's dock.
ETP: estimated time of pickup	Estimated time at which a loading unit will be available for (generally truck) pickup at its inbound CT terminal.
freight forwarder	A company that serves as an intermediary between its customer and combined transport operators. See also *logistic service provider*.
IM: infrastructure manager	A company that operates the rail track infrastructure on which other companies operate their trains. An IM typically covers a single European country.
intermodal transport	Transport of freight whose journey involves several surface modes (water, rail or truck). See also *combined transport*.
KV: kombinierter Verkehr	German for combined transport.
KV4.0 Data Hub	The router for CT data exchange of the company DXI that began commercial operation in March 2023.
loading gauge	The maximum dimensions of a train running on a section of rail line. A critical dimension is height. An EU objective is to raise the height on all CT lines to accommodate a standard 4-meter-high semi-trailer on a standard pocket wagon.

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Term	Meaning in the context of European combined transport
LSP: logistic service provider	A company under contract to organize the logistics of an industrial company. Serves as an intermediary between its customer and a combined transport operator. See also *freight forwarder*.
LU: loading unit	Also known as an *intermodal loading unit*. Can be a container, truck trailer or swap body (i.e., a truck trailer without wheels).
path	The right to run a train on a route on a given schedule on a given day.
pocket wagon	A wagon containing a depressed pocket to accommodate the wheels of semi-trailers. This design helps assure that a train will fit a line's loading gauge.
RFC: rail freight corridor	The EU has defined a number of such corridors.
RNE: RailNetEurope	The technical sector association of Europe's railway *infrastructure manager*s.
RoLa: *rollende Landstrasse*	German term for rail transport of complete tractor-trailer rigs. The abbreviation *RoLA* is also used in English in Europe.
RU: railway undertaking	In Europe, a company that operates trains. Under European law, railway undertakings and *infrastructure managers* are separate entities.
SCVP: supply-chain visibility provider	A company that provides its customers with information on the customer's shipments, including location, status and estimated arrival time.
swap body	A semi-trailer without wheels. The design of a wagon carrying a swap body can be simpler than that of a *pocket wagon* able to accommodate a semi-trailer and its wheels.
TAF TSI	*Telematic applications for freight* (TAF), which are part of the *technical specifications for interoperability* (TSI) of the European railway sector. This EU regulation governs data interchange on timetables, train composition and train operation.
TEN-T	*Trans-European Transport Network*, a main basis for prioritizing the infrastructure improvements the EU finances.

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Term	Meaning in the context of European combined transport
Terminal	A facility that transfers *loading units* between trains and barges, ships, trucks and other trains. Also called *transshipment terminal*.
TEU: twenty-foot equivalent unit	A 20-foot container or equivalent transport capacity.
TIS: Train Information System	Provided by *RailNetEurope*.
Tracking	Knowing where a shipment or transport asset is or was, when. Also called *tracking and tracing*.
traction provider	See *railway undertaking*.
UIRR	International Union of Road-Rail Combined Transport, the association representing European CT actors.
wagon	A freight-carrying unit that couples with others to form a train. Called a *car* or *railcar* in North America.
wagonload	Rail transport of freight in wagons that carry their own freight (as opposed to carrying loading units) in which individual or small groups of wagons move between their origin and destination via shunting facilities that add or remove them to/from trains. Called *carload* in North America.

3.1 Role of UIRR

In the realm of rail-based combined transport (as opposed to rail-hauled bulk, wagonload and automobile traffic), the central actor that needs and therefore holds the most comprehensive data on the movement of a shipment is the CT operator.

These operators are grouped in the Brussels-based *International Union for Road-Rail Combined Transport* (UIRR). Over the past two decades, working with the RailNetEurope association of European infrastructure managers, UIRR has been promoting the development of standardized data exchange among CT operators, their operational partners and their customers.

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Containers ready for departure and two locomotives in the Kleinhüningen district of the port of Basel, 19 September 2023. Photo George Raymond.

3.2 Separation of trains and infrastructure

In North America, freight railways are vertically integrated, i.e. a single company typically owns both the locomotives and the track infrastructure on which they haul trains.[1] A big transatlantic difference is that under EU policy implemented over the last three decades, European railways are no longer vertically integrated: in each country, a so-called infrastructure manager (IM) maintains and operates the rail network and any number of railway undertakings (RUs) run the trains. The intent of this policy has been to have a public agency analogous to a state highway department make available the rail network to a number of competing RUs analogous to competing trucking companies.

Two essential roles of the IM are to sell train paths to RUs and to coordinate train traffic, especially in situations where trains don't run on schedule.

RUs can in principle be international, but often are segmented into country-specific divisions because of language and technical barriers at borders. Nevertheless, roughly two-thirds of UIRR members' consignments cross borders.

[1] In some cases, on the basis of bilateral agreements, North American locomotives do haul trains on rail lines belonging to other railways.

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3.3 Loading units in combined transport

Combined transport moves *loading units*, i.e.: containers, semi-trailers and swap bodies.

A swap body is a truck trailer without wheels that is like a container but is non-stackable. The design of a wagon that can carry swap bodies can be simpler than that of a pocket wagon, which accommodates the semi-trailer's wheels so the semi-trailer can ride low enough to fit within the loading gauge of European rail lines.

4 Combined transport in 2022

We now turn to the performance of European CT in 2022, including the scope of its network operations in section 4.1 and the year's trends in section 4.1.

4.1 CT network and operations in Europe in 2022

The UIRR has 51 members (CT operators and CT terminals), of which four joined in 2022. A number of members operate both CT trains and CT terminals.

UIRR members operate 142 terminals and comprise 27 operators. In 2022, they ran 169,000 trains on 246 country-to-country relations and moved 5.1 million consignments or 30.1 per train. (Some consignments move on several trains in succession.) The average run of an UIRR member's train is 800 km.

UIRR members own or lease 12,200 wagons, 75% of which are for containers and 25% pocket wagons that accommodate the wheels of semi-trailers.

The 142 UIRR terminals have an average of 3.6 tracks, 4.1 scheduled destinations and 3.1 gantry or mobile cranes and handle 4.7 inbound or outbound trains per day, assuming a six-day week.

4.1 Trends in combined transport in 2022

2022 brought CT's robust growth since 2020 to a halt. Historic highs in domestic and intra-EU traffic were offset by a collapse of intercontinental carriage, which for UIRR members mainly involves Russia and China.

Of the 5.1 million CT consignments UIRR members carried in 2022, about 31% were domestic and the rest trans-border.

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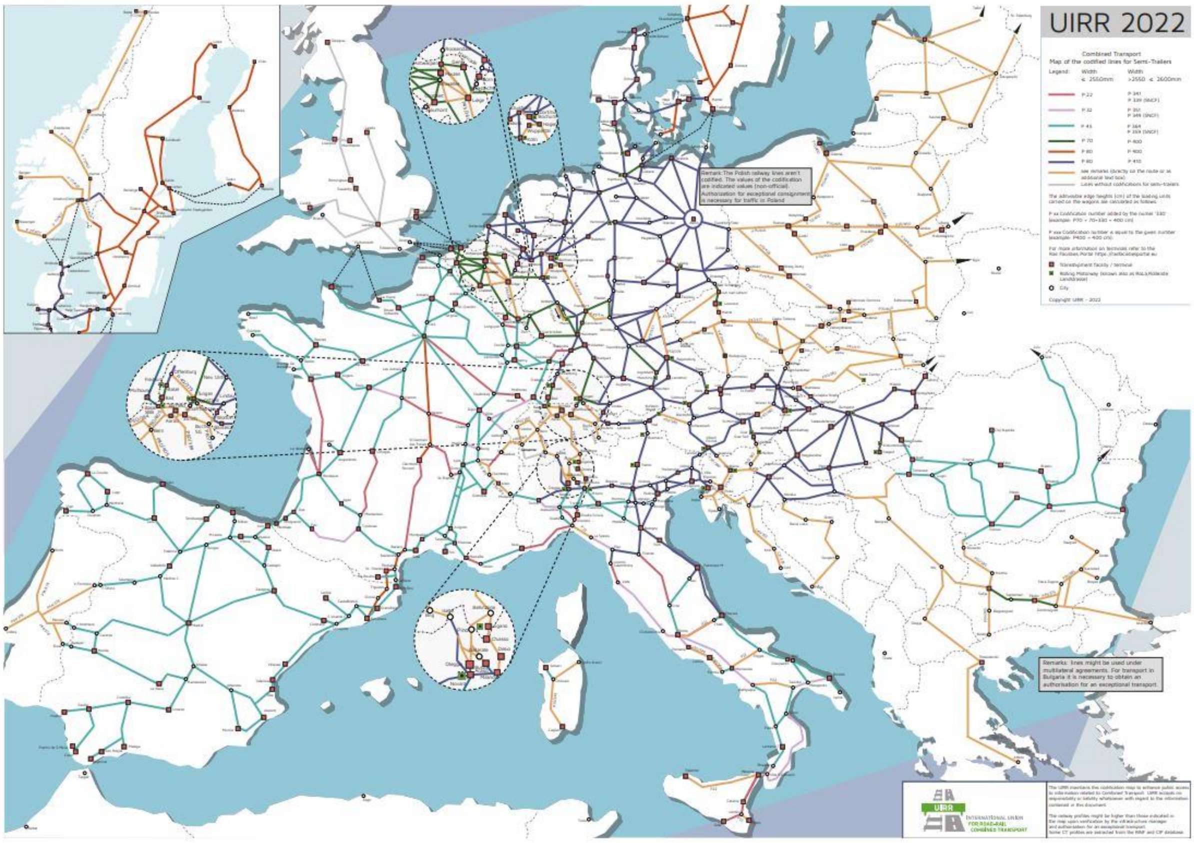

The 2022 UIRR map of combined transport showing the loading gauge of each line, which governs permissible train height when transporting semi-trailers. From the UIRR 2022-2023 annual report.

Negative factors in 2022

European combined transport's 2022 performance was hurt by:

- The Russian invasion of Ukraine.
- An energy crisis marked by high electricity costs for trains, but steady diesel prices for trucks.
- Capacity restrictions and punctuality problems due to extensive renewal and improvement work on Europe's rail infrastructure.
- A macroeconomic downturn, particularly in Germany.

Domestic rises, intercontinental plunges

In 2022, while UIRR members' single-country traffic grew at a record pace, cross-border traffic within the EU stagnated and intercontinental traffic (mostly involving Russia and China) plunged.

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	2022 consignments (change from 2012)	2022 tonne-km (change from 2021)
Domestic combined transport	+5.64% (all-time record)	+9.48% (all-time record)
Intra-EU border-crossing CT traffic	-0.5%	+1.66%
Intermodal traffic outside the European Union – mainly between Europe and Asia	-48%	-82%
Total	**+0.3%**	**-11.7%** (reflects loss of outside-EU traffic, mainly with Russia and China).

Semi-trailers up, tractor-trailers rigs down

Of the 5.1 million loading units UIRR members carried in 2022, 80% were containers (including swap bodies), 16% were semi-trailers, and 4% were complete tractor-trailers rigs (RoLa). In 2022, UIRR members saw healthy growth in semi-trailer transport but significantly fewer complete tractor-trailer rigs.

	2022 consignments (change from 2012)
Semi-trailer transport	+9.6%
Transport of complete tractor-trailer rigs (RoLa)	-23%

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Far from home. Xi'an is an inland port deep in the Chinese hinterland; these containers probably reached Europe by rail. Villach, Austria, 14 August 2021. Photo George Raymond.

5 How combined transport can help the EU meet its objectives

The EU's Fit for 55 campaign pledges a 55% carbon emission reduction by 2030 (compared to 1990) and a net-zero Europe by 2050.

In addition to decarbonization, the EU also has objectives for energy efficiency, fossil-fuel decoupling and cleaner air. To meet these objectives, the EU aims to double rail freight's market share by 2050. As the most efficient way to bring trucked cargo onto trains, combined transport offers the means to achieve this goal. But this means that CT needs to complete its own decarbonization and grow by an average of 5% per year.

This chapter's section 5.1 describes the contributions of CT. Section 5.2 details what CT needs in order to do its part.

5.1 The contributions of CT

In Europe, political and policy pressure is growing to shift shipments from road to rail to reduce CO_2, other emissions and road congestion. UIRR says that door-to-door combined

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transport offers the most affordable, efficient and lowest-risk path to realizing EU policy objectives. CT intelligently connects rail, road and waterways to:

- Increase the energy efficiency of long-distance inland transport by up to 70% compared to door-to-door trucking.
- Reduce Europe’s dependence on imported energy.
- Reduce the carbon footprint of inland freight transport by up to 90% compared to door-to-door trucking, thus contributing to climate change mitigation and decarbonization.
- Ease the impact of missing truck drivers on Europe’s economy.[2]
- Offer high-productivity jobs offering a competitive work/life balance.
- Cut back on noise and particulate pollution.
- Reduce degradation of road infrastructure.
- Mitigate road congestion and accidents by shifting trucks to trains.

CT is pursuing its own decarbonization by electrifying trucks and terminal equipment. Most European CT rail lines are already electrified.

5.2 What CT needs in order to do its part

The UIRR says that if CT is to help the EU meet its objectives by 2050, CT requires the following:

- €16.5 billion a year for the rail infrastructure to meet the TEN-T parameters, which include the 4-meter loading gauge, 22.5-tonne axle load and 740-meter trains.
- €1.5 billion a year for intermodal assets like terminals, loading units, intermodal wagons, skeleton trailers for road haulage of containers, and digitization.
- A regulatory environment that provides intermodal freight train paths in sufficient number and quality.

In this context, UIRR sees these roles of government agencies as central:

- Funding of rail infrastructure
- Funding and regulation for IT platforms
- Encouragement and requirements for data sharing and open platforms, using a carrot and stick approach.
- Alignment of customs processes.

[2] It is said that ever fewer young people are willing to spend their nights parked in truck cabs at motorway rest stops.

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Illustration of clearance for 4-meter semi-trailers riding on pocket wagons on 20 September 2019 at Switzerland's rebuilt Bözberg tunnel, which has since opened. Photo George Raymond.

6 Information needs in combined transport

6.1 The CT process

Combined transport typically involves the transport of loading units:

- by rail (or barge) over longer distances and
- initial pickup and final delivery by truck.

The typical process of moving a loading unit (LU) in CT is thus as follows:

1. Truck retrieves LU at customer dock and drives it to outbound terminal.
2. Outbound terminal tranships LU from truck to train (or barge).
3. Train (or barge) carries LU on long-distance journey.
4. Inbound terminal tranships LU from train (or barge) to truck.
5. Truck drives LU to destination customer dock.

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Combined transport and windmills in the port of Hamburg. 18 September 2019. Photo George Raymond.

However, the following variants often also arise in combined transport:

- The LU moves via a seaport.
- The LU moves via an intermediate combined-transport terminal, in which case it runs on two trains in succession.
- CT trains may split or join en route.
- In big ports like Hamburg, wagons carrying LUs can be shunted in small groups to assemble trains.

Also, CT trains often must stop at borders to change driver or locomotive.[3]

[3] Historically, each European railway had its own signalling system and sometimes its own electrification standards. A train therefore often had to change locomotives when it reached a border. The development of locomotives able to operate with several countries' signalling and electrification and EU standardization efforts have made locomotive changes somewhat less frequent – but has also increased locomotives' cost.

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6.2 Key stakeholders

Here are the key stakeholders in CT and their focus:

- Shipper: goods
- Logistic service provider: loads
- Terminals: loading units
- CT operators: loading units and trains
- Rail infrastructure operators: trains
- Railway undertakings (rail traction providers): trains
- Wagon owners: wagons
- Receiver: transport order and goods
- Authorities: regulations and customs
- IT providers whose systems help the other stakeholders plan, book, track and execute CT shipments.

6.3 Information needs in the CT process

Customers of combined transport have the following information needs before, during and after CT transport:

1. Schedules and cost: monitoring and determining prices and schedules of different alternatives before booking.
2. Booking process. Result: expected price and schedule.
3. **Update of shipment location and ETA (our focus here).**
4. Negotiation of alternative service options and costs before or during shipment. Examples of options: use different outbound/intermediate/inbound terminal; make LU's whole journey by road.
5. Evaluation of historical performance against (updated) plan; checking of invoices.

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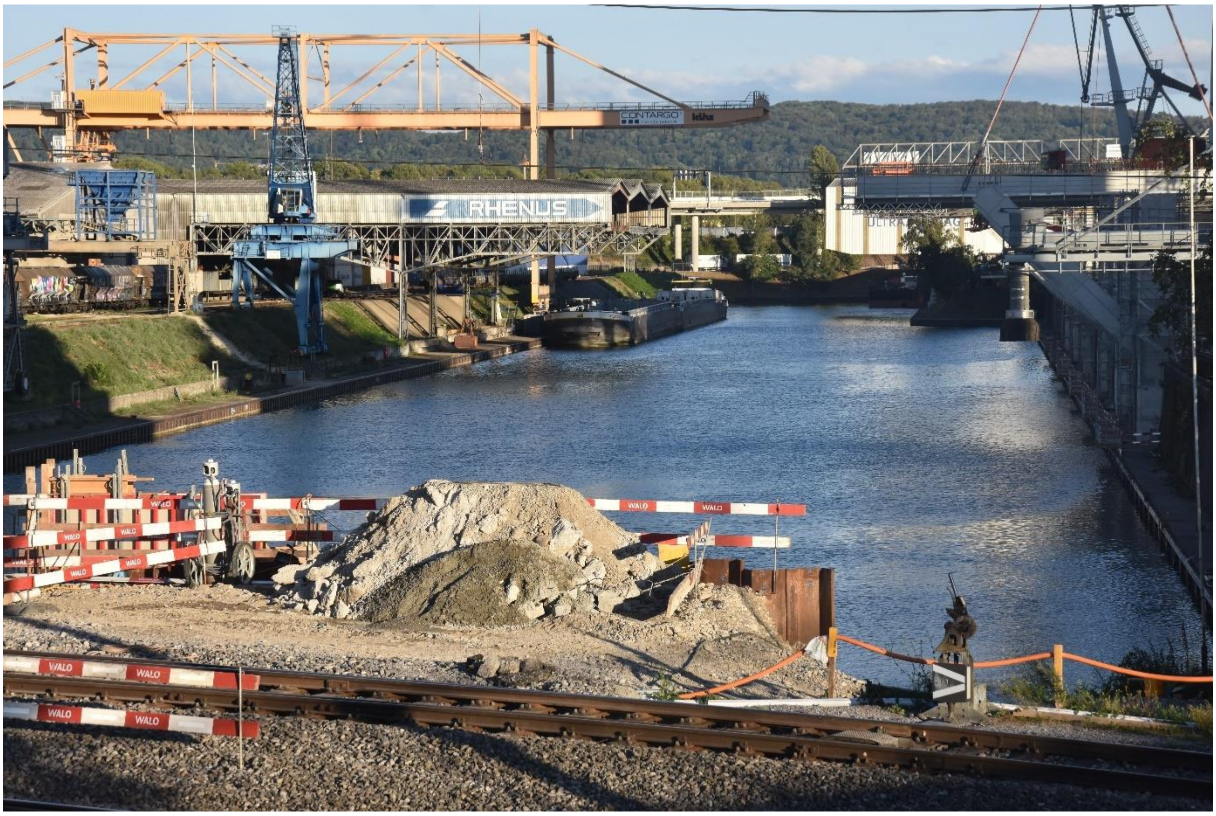

Freight-handling facilities in Basel's Port Basin 2, including the yellow crane of the Contargo container terminal and waiting container barges on the basin's north side. 19 September 2023. Photo George Raymond.

6.4 Disturbances and needed information

In combined transport, disturbances can arise due to strikes, bad weather, rolling-stock breakdowns and line blockages. Line blockages may be known more or less in advance (as in the case of track work) or arise suddenly.

Updated information is needed case of any of the following events:

- Train diverted to a different outbound or inbound terminal.
- Some or all of an LU's journey is shifted from rail to road.
- Defective wagon is removed from train (with its LUs).
- For trains leaving or entering the EU: LU detained by customs.

In case of any of these events, the CT operator and CT customer need answers to questions like the following:

- Where is my LU now? What wagon is it on? What train is that wagon in?
- When will the LU's train arrive at its inbound terminal?

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- Will the LU's train be diverted onto another route? Will the LU connect between trains at an unplanned terminal?

Given the expected arrival time (ETA) of an LU's train:

- At an intermediate terminal, what train will the LU connect to and when will that train arrive at its inbound terminal?
- At the LU's inbound terminal, when will it be available for pickup by a truck?

6.5 Digitization enables combined transport to reach its potential

Given the complexity of combined transport, in terms of the number of both involved actors and required operations to move a loading unit from A to B, only digitization allows CT to reach its potential and gain the visibility that customers now require.

The main mission of digitization in CT is therefore to reduce the burden of CT's complexity.

Integrating CT within a supply-chain visibility platform requires taking account of the specific complexities of CT compared to plane, ship and truck.

6.6 Estimated time of arrival

In combined transport, as in all other transport, a critical piece of information for customers is always estimated time of arrive (ETA). An objective is generally ETA management by exception.

In CT, estimating the time of arrival (ETA) of a loading unit requires integrating:

- Real-time knowledge of what locomotives are pulling what wagons carrying what LUs.
- GPS location reports from these elements. (Such reports are increasingly available.)
- Links between these elements and the IDs of trains operating on the network of each national infrastructure operator (IM).
- ETA information for each train ID from each IM.

In the term ETA, the word "arrival" can mean different things to different stakeholders and thus needs careful definition in a given context. Some possibilities for the meaning of "arrival":

- The inbound train has arrived from its line-haul trip and is ready to be shunted into the terminal.
- The inbound train has been placed on the track within the inbound terminal where it will be unloaded.
- The LU is available for truck pickup at the inbound terminal.

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- A truck has delivered the LU to its destination customer dock.

The then newly opened combined-transport terminal in Burghausen, Germany, east of Munich and north of Salzburg. 3 May 2016. Photo George Raymond.

7 The CT sector’s response to its information needs

This chapter presents how the CT sector is gathering and providing information in Europe. It reviews the current two-year EDICT project (section 7.1), data exchange formats (section 7.2), code registers and reference databases (section 7.3), location reporting (section 7.4), applications for CT data exchange (section 7.5) and a collaborative quality management system for CT (section 7.6).

7.1 The EDICT project

EDICT, or Enhanced Data Interoperability for Combined Transport stakeholders, is an EU co-funded project coordinated by UIRR. Its main objective is to boost data sharing and data interoperability within the CT community.

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EDICT seeks interoperable information sharing in CT based on standardized messaging, for example for LU tracking.

The UIRR says that the EDICT project will bring considerable advances to CT terms of digitization, data quality, decision-making and quality management.

The UIRR sees three phases in the digitization in CT: standardization (which was mostly completed by 2021), ongoing enhancement and market uptake in 2019-2025 and the unfolding of digitization's full impact in 2025-2030.

7.1.1 EDICT stakeholders

EDICT stakeholders include:

- CT terminals,
- CT operators,
- Infrastructure managers (IMs),
- Railway undertakings (RUs) and
- CT customers.

This last group is of course the most important. EDICT seeks to enlarge the scope of CT data exchange to include stakeholders not traditionally included, particularly customers that can be variously characterized as shippers, industrial firms, freight forwarders and logistics service providers (LSPs).

7.1.2 The EDICT project consortium

The EDICT project consortium consists of nine project partners comprising CT operators, terminal operators and IT providers:

- CESAR Information System (CIS), Brussels
- Combinant (Antwerp)
- Duisport (Duisburg)
- Hupac (Switzerland)
- Kombiverkehr (Germany)
- Port of Rotterdam
- Rail Cargo Group (Austria)
- WienCont (Vienna)
- UIRR.

Two subcontractors are also involved. The two-year, €3.1-million project will end in September 2024.

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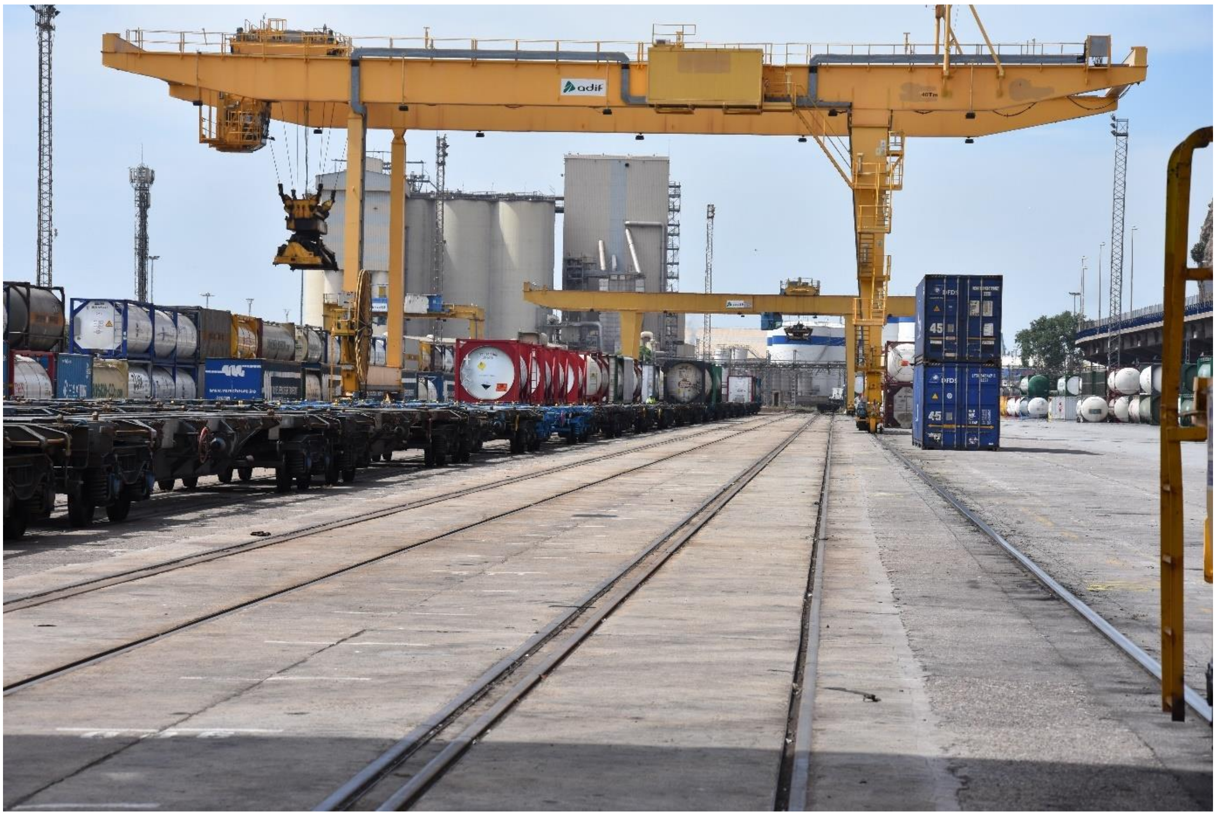

Three-rail track to handle both standard (1435 mm) and Iberian (1668 mm) gauge wagons. Morot terminal, Barcelona. 9 June 2016. Photo George Raymond.

7.1.3 EDICT: connecting CT terminals

A central focus EDICT is connecting CT operations to the transshipment terminals they use. CT terminals range from single-purpose inland CT facilities to CT facilities that are part of a large seaport. EDICT is thus focusing on the following tasks:

- Integrating terminals in rail-sector data exchange.
- Adapting terminal operating systems (TOSs).
- Designing a common and standardized interface for terminals.
- Developing electronic data exchange between terminals and the CT sector.
- Defining harmonized timestamps based on agreed operational milestone definitions.
- Integrating the estimated time of pick-up (ETP) of the loading unit based on train ETA.

7.1.1 Central EDICT components

The central EDICT IT components for all stakeholders include:

- Data exchange formats including EDIGES (for CT), TAF TSI (for rail freight) and eFTI (for freight in all modes). See section 7.2.
- Code management, and reference registers and databases. See section 7.3.
- Applications for data exchange such as CESAR-NEXT, RailNetEurope's Train Information System (TIS) and the KV4.0 data hub for CT. See section 7.4.

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- Location reporting based on GPS. See section 7.5.
- A collaborative quality management system, including harmonization of reason codes for delays and cancellations. See section 7.6.

7.1.2 Related EDICT components

In support of the central EDICT components, UIRR is also fostering developments in the following areas, among others:

- Timetabling processes and their alignment.
- Alignment and standardization of transaction documents.
- Wagon specifications: how long, how heavy, and what kinds of LUs can they carry?
- Sensors to automatically confirm what loading units are on a wagon.
- The emerging concept of synchro-modality.

7.2 Data exchange formats

The most relevant data exchange formats for CT are EDIGES, which specifically addresses CT (section 7.2.1), TAF TSI for all rail freight (section 0), eFTI for freight transport in all modes (section 7.2.3) and the DCSA standards for data exchange in maritime shipment of containers (section 7.2.4).

7.2.1 Data exchange for CT: EDIGES

EDIGES stands for Electronic Data-Interchange Intermodal Global European Standard. CESAR (see section 7.5.2 below) developed it. Here is an overview and a list of the message types maintained by the EDIGES Consortium.

The main categories of EDIGES data are: master data, commercial timetable, booking data for LSPs, terminal status, terminal slots, train run information, tracking, train arrival, train ETA, loading unit ETP, LU pickup, and gate-out.

One of the three CT operators leading the development of EDIGES has been Hupac, whose headquarters is in Chiasso, on the southern tip of Switzerland on the border with Italy.

The objective of EDIGES is to implement standardized communication to integrate:

- all actors in the intermodal logistics chain
- information on every process within the CT chain, including booking, first/last-mile truck operations, terminal activities, train running information and ETA/ETP.

EDIGES is one of the standardization measures promoted by UIRR to facilitate CT use by enhancing interoperability between the truck, rail and waterborne modes connected by intermodal technology.

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EDIGES and ETA

Section 6.6 described the information requirements of estimated time of arrival. ETA in combined transport was the subject of the [ELETA] project, which ended in 2019, and an [ETA Management Platform] developed by the company HaCon, a Siemens unit. At the time, an AI-based ETA approach was presented by the company Synfioo, which has since been bought by Project44. Initiatives to improve ETAs are ongoing.

Double-stacking is the norm on North American container trains. This is Canadian National's former Rockingham Yard in Halifax on 6 July 2018. What is now PSA's north terminal is in the background. On 20 September 2023, CN renamed the yard for Robert Pace, the railway's longtime chairman. Photo George Raymond.

7.2.2 Data exchange for rail freight: TAF TSI

TAF stands for *telematic applications for freight* (TAF) and is part of the *technical specifications for interoperability* (TSI) of the European railway sector.

A corresponding EU regulation governs data interchange on timetables, train composition and train operation. The TAF TSI Regulation describes:

- Processing before, during and after a shipment's trip.
- The use (sequences) of messages and their XML structure based on *XML Schema Definitions* (XSDs).
- In other words: the contents of the messages, but also who must send what kind of message when.

TAF TSI messages are exchanged among identifiable and eligible stakeholders.

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The Agency for Railways of the EU (ERA) manages the change-control process for TAF TSI, including:

- Adaption of the CT-related TAF TSI messages and of shared CT-related reference registers on locations, companies, loading units and wagons within TAF TSI.
- Management of milestones for implementation of the corresponding amended TAF TSI legal text between 2023 and 2027 as part of the new TAF Master Plan.

For ERA, the CT-specific EDIGES messages are "soft compliant" with TAF TSI.

TAF TSI and EDICT

UIRR says that the objectives of EDICT are fully aligned with the TAF TSI Regulation.

An objective of EDICT is to enhance the TAF TSI data model and promote TAF TSI compliance and standardization. An example is harmonization of process milestones in CT operations, mainly at terminals.

UIRR has been working for 10 years to enlarge the scope of TAF TSI message exchange from IMs and RUs – the original scope of TAF TSI – to terminal operators and CT operators. One EDICT focus is now to boost the attractiveness of international CT using TAF TSI-related CT data messages to remove interoperability barriers.

The EDICT project is proving to be a vehicle for transposing several key TAF TSI functions into daily practice.

Intermodal train in Tbilisi, capital of Georgia. 10 February 2019. Photo Pierre-Noël Rietsch.

TAF TSI process and corresponding messages

The TAF TSI process Regulation (EU) 2021/541 prescribes the following components and messages.

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Reference data for rail locations and for companies.

RU-IM Communication:

- Path request
- Train composition
- Train ready
- Train run and forecast
- Service disruption

RU-RU Communication:

- Consignment order
- Wagon events
- Estimated time of interchange
- Estimated time of arrival

Terminals[4]:

- Consignment order
- Train composition
- Train ready
- Train run and forecast
- Service disruption
- Estimated time of interchange
- Estimated time of arrival

Wagon movement:

- Estimated Time of Arrival (ETA) or of Interchange (ETI)
- Wagon events

TAF TSI features now under development

The following features are currently being developed within TAF TSI:

- Integration of GPS tracking of vehicles.

- Better data access for first and last mile actors.

- Linking real-time multimodal data and train data, including ETA. A new provision is estimated time of availability for pickup (ETP) of a loading unit at the arrival terminal based on the ETA of the LU's train. UIRR reports that the results of the ELETA project (see section 6.6) are now part of the TAF TSI regulation.

- Post-trip exchanges to improve quality and productivity, including archiving of train running information (train ID, reporting location, actual vs. planned date/time, delay and delay cause) by IMs in case of customer complaints.

[4] The operating systems of CT terminals need adaptation to assure compliance with TAF TSI.

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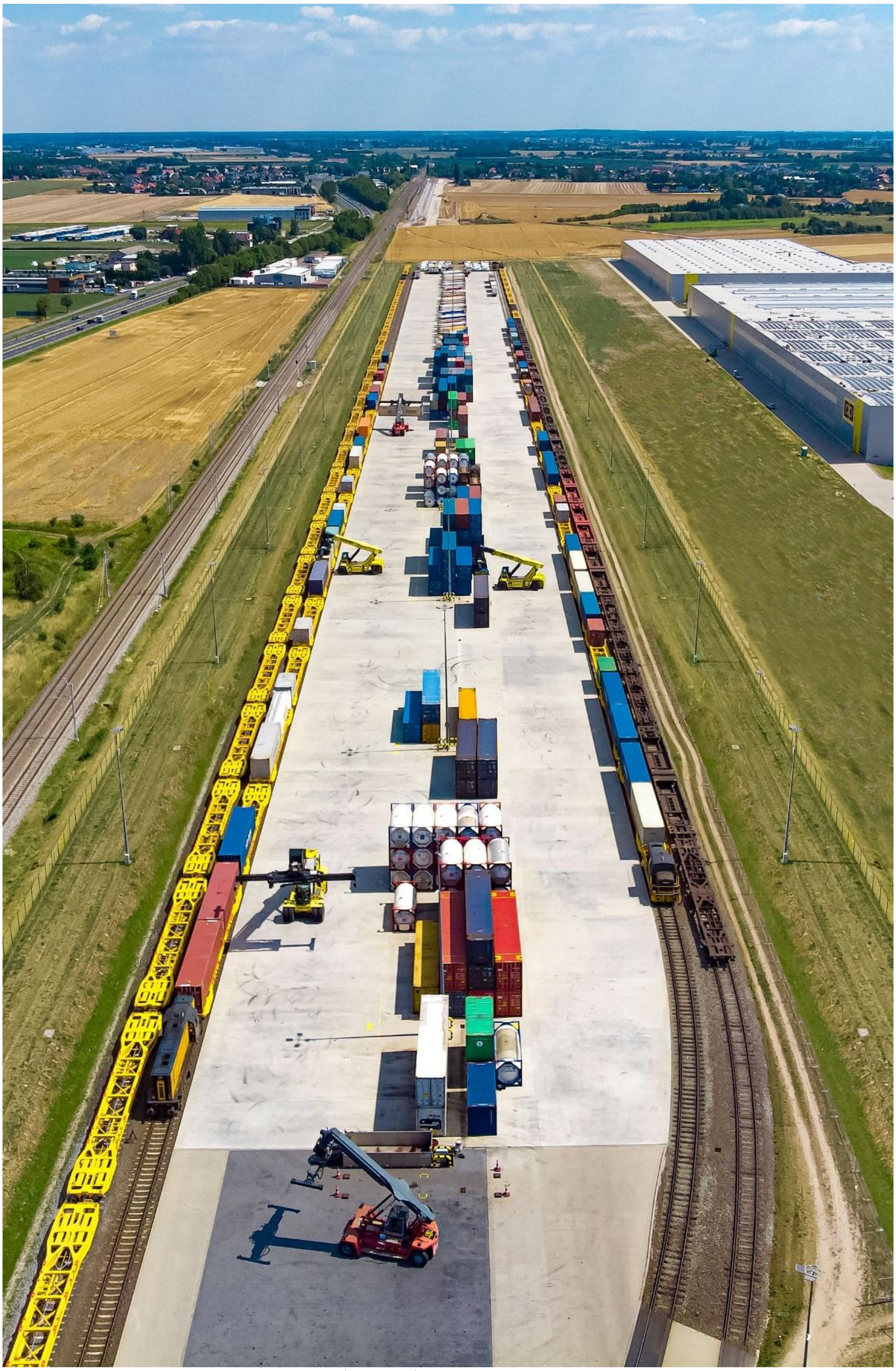
Combined-transport terminal in Jasin (Posnań), Poland. 30 July 2019. Photo © CLIP Group.

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7.2.3 Data exchange for freight in all modes: eFTI

EDICT seeks to improve data exchange for freight transport in all modes based on the European eFTI standard and messages. A focus is integration of EDIGES and TAF TSI messages.

7.2.4 DCSA data exchange for maritime shipments

The DCSA standards for data exchange in maritime shipment of containers, including land legs, are well known to many SCVPs. These standards are relevant to European CT because a substantial number of maritime containers move on both container ships and European CT trains.

A party involved in the shipment of a maritime container now demands seamless visibility of the container's whole journey. Providing such visibility a visibility provider's core business. Given their differing viewpoints, the terms, concepts and rules in European CT data exchange differ somewhat from DCSA's, but mapping their relationship appears feasible if not yet done.

7.3 Code registers and reference databases

7.3.1 UIRR code management

UIRR has developed a platform providing the most relevant codes supporting data exchange among CT stakeholders. The UIRR's code management platform (CDM) comprises both legally imposed codes, such as those for dangerous goods, and sectorial codes that UIRR manages. These codes enable automatic integration of transport information into the CESAR, RNE TIS and KV4.0 systems presented in section 7.5.

7.3.2 Location codes and CT terminals

CT transshipment terminals are located along the TEN-T network. They are the gateways for most types of cargo that trucks bring to rail and water transport. Trucks carry LUs over the short legs that connect the customer's point of origin or final destination with a transhipment terminal.

The UIRR 3-digit code for intermodal terminals is to be part of the TAF TSI reference file for locations.

Transshipment terminals also appear in the Rail Facilities Portal (RFP), which contains information on all kinds of rail freight facilities. This is integrated within RailNetEurope's larger rail information system (RIS).

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7.3.3 Loading unit identification

EU law requires that intermodal loading units (ILU) such as non-ISO containers, swap bodies and semi-trailers – whether cranable or not – be identified by the ILU-Code. The ILU Single Reference Database is a new feature of the EU's TAF TSI regulation.

7.4 Location reporting

Unlike their North American counterparts, European wagons lack standardized RFID tags on the wagons and a corresponding network of wayside readers. Increasingly, however, GPS devices report the location of locomotives, wagons and LUs.

In combined transport, one benefit of location reporting is to confirm that a wagon is (still) on a particular train and a loading unit is (still) on a particular wagon.

Locomotives supply no power to wagons (at least for now[5]), so GPS devices on wagons are battery powered. The desired intensity of tracking tends to rise with cargo value and sensitivity (such as dangerous goods). Reporting may be spotty in rural areas where communication towers may be missing. But reports from towns and cities often suffice.

7.5 Applications for CT data exchange

This section presents three prominent applications that facilitate CT data exchange: RNE's train information system (section 7.5.1), CESAR and its new generation, CESAR-NEXT (section 7.5.2) and DXI's KV4.0 platform (section 7.5.3).

7.5.1 RailNetEurope's train information system

RailNetEurope calls its Train Information System (TIS) application a highly trustworthy data source for infrastructure-related train running information.

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[5] This may change with the implementation of the European Digital Automatic Coupler (DAC), whose rollout has been announced for 2030.

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On 3 June 2023, Swissterminal opened its tri-modal (Rhine, rail, truck) facility to the public during the Basel Port Festival. Photo George Raymond.

TIS as backbone of the Digital Train

RailNetEurope sees TIS as the backbone of what RNE calls the *Digital Train*, whose main elements are follows:

- Terminal data connection.
- Train composition and train run.
- GPS tracking for train, wagon and loading units.
- Train running forecast.
- Punctuality monitoring reporting.
- Collaborative decision making.

TIS owners

TIS belongs to RailNetEurope, the technical association of the European railway infrastructure managers.

Data sharing

At his 10 May 2023 presentation of TIS at the UIRR event in Munich, RailNetEurope CEO Harald Reisinger said that the rail sector has apparently learned that exchanging data makes us stronger.

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Under the revised TAF TSI regulation, information can be exchanged with all identifiable stakeholders involved in the train run. Mr Reisinger said that "if you don't where your train is, it's your own fault. The data is there."

An ongoing challenge, however, is determining whether the train is "yours", in other words deciding whether a party is a stakeholder involved in a train run who is entitled to some well-defined part of the data on the train.

TAF TSI messages as the basis for TIS

The basis for the data exchange underlying TIS is the TAF TSI message framework and particularly the TAF Train Run and Train Composition messages, including:

- Train characteristics: length, weight, wagons, maximum speed.
- Wagons: length, empty weight, loaded weight, number of axles.
- Train movement: date and time of train's passage at waypoints and deviation from schedule.

Mr Reisinger said that TAF TSI's Train ID numbers that identify trains are still a problem, especially when trains are split/joined in terminals.

Integrating terminals within TIS

Terminals are the interface between transport modes along logistics chains. Despite the benefits of data sharing in terms of better resource use, each terminal still has its own views on data sharing. RNE is therefore working to:

- Get more terminals into TIS.
- Share the first and last mile information for rail services with cooperating trucking companies.
- Include not just train running but also train composition data.

Current use volumes of TIS

- TIS identifies some 30,000 (freight and passenger) national and cross-border trains daily.
- Around 4,000 users from 350 companies connect every month with TIS.

TIS website and app

The TIS data is available via data exchange or in the form or a website and an app. TIS comprises timetables, path cancellations, real-time train monitoring, train delays, incident management, and an app for train drivers featuring GPS data.

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Fees

TIS fees are as follows:

- Users can access their data via the TIS website and app at no charge.
- Data exchange is subject to various charging schemes based on train volume.

7.5.2 CESAR-NEXT

CESAR-NEXT is the next generation of CESAR data exchange, which began in 2003.

Since 2003: CESAR

CESAR stands for Co-operative European System for Advanced information Redistribution. It is a common European platform the exchange of transport-related information between CT operators and their customers. This information is pooled within the CESAR Information System (CIS).

The IT service company CESAR Information Services (CIS), based in Brussels:

- Runs the CESAR system.
- Coordinates the integration of additional operators.
- Puts in place functionalities for trans-European communication among CT operators and with CT customers, which CESAR call "B2B" communication.

CESAR Information System owners

The owners of CIS include the CT operators Hupac (Switzerland), Kombiverkehr (Germany), Mercitalia Intermodal (Italy), AdriaKombi (Slovenia), Rail Cargo Operator (Austria) and Novatrans (France).

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Spoil heaps from abandoned coal mines overlook the combined-transport terminal in Dourges, northern France. 25 March 2019. Photo George Raymond.

CESAR in 2022

Facts and figures for CESAR in 2022:

- 1632 customers (large, medium and small companies).
- About 2.7 million shipments and 17.6 million shipment events.
- 320 European terminals involved.
- About 7 million queries and 16 million web pages requested.

Since 2 May 2023: CESAR-NEXT

CESAR-NEXT is a continuation of the services offered by the CESAR platform (2004-2023) with new functionalities and a new platform architecture based on state-of-the-art technology. CESAR-NEXT calls itself "the open tracking application for CT". It went live on 2 May 2023.

CESAR-NEXT has advanced from CESAR's rail focus to offer a multimodal transport management capability that integrates all surface transport modes – rail, road, maritime and barge – and new status information such as estimated time of pickup (ETP).

The shareholder operators of CIS have fully funded the CESAR-NEXT project investment.

An open, collaborative platform

CESAR calls CESAR-NEXT is an open, collaborative platform for CT that supports EU projects related to terminals and rail freight like EDICT. It is a multi-section tracking platform designed to attract CT operators, CT terminals and CT customers (especially LSPs) that provides access to all transport information from the connected intermodal operators.

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Partner integration

The CESAR-NEXT platform integrates CT partners (including LSPs) to provide timetables, transport booking and tracking. It provides a global overview of multi-section European shipments by connecting rail, road, short-sea and barge sections.

Basis: EDIGES

The basis for data exchange in CESAR-NEXT is full integration of the EDIGES standard messages. This encourages more logistics companies to use combined transport.

Estimated time of pickup (ETP)

Customers want to know when they can retrieve LUs arriving on late trains. Such a customer asks: How fast can the terminal process my LU, given that its inbound train is arriving 3 hours late? When should I send my truck driver so that I don't have to pay them to wait?

The information sharing facilitated by CESAR-NEXT and its integration of GPS location reports and train running information from RailNetEurope's TIS allows better prediction of when a loading unit will be available for pickup.

CESAR-NEXT website sections

The CESAR-NEXT website offers registered users the following kinds of access and information on LUs and on the trains carrying them:

- Searches by individual LU numbers or – and this is new – filtered by a customer's LU fleet.
- Terminal situation views with filters.
- Train composition and transport irregularities sent by the railway undertaking or CT operator.
- Problems with my LU or its train or wagon.

The CESAR-NEXT B2B data-exchange service

The target of the CESAR-NEXT "B2B" data-exchange service is CT customers (such as LSPs), who can set up continuous download of all transport data and status updates. The customer can integrate this information into his own IT system to enable a continuity of information over the whole logistics chain. So far, 18 B2B customers have full CESAR-NEXT data-exchange connections.

Fees

Access to the CESAR-NEXT website is free. The yearly fee for the B2B download service is based on customer size.

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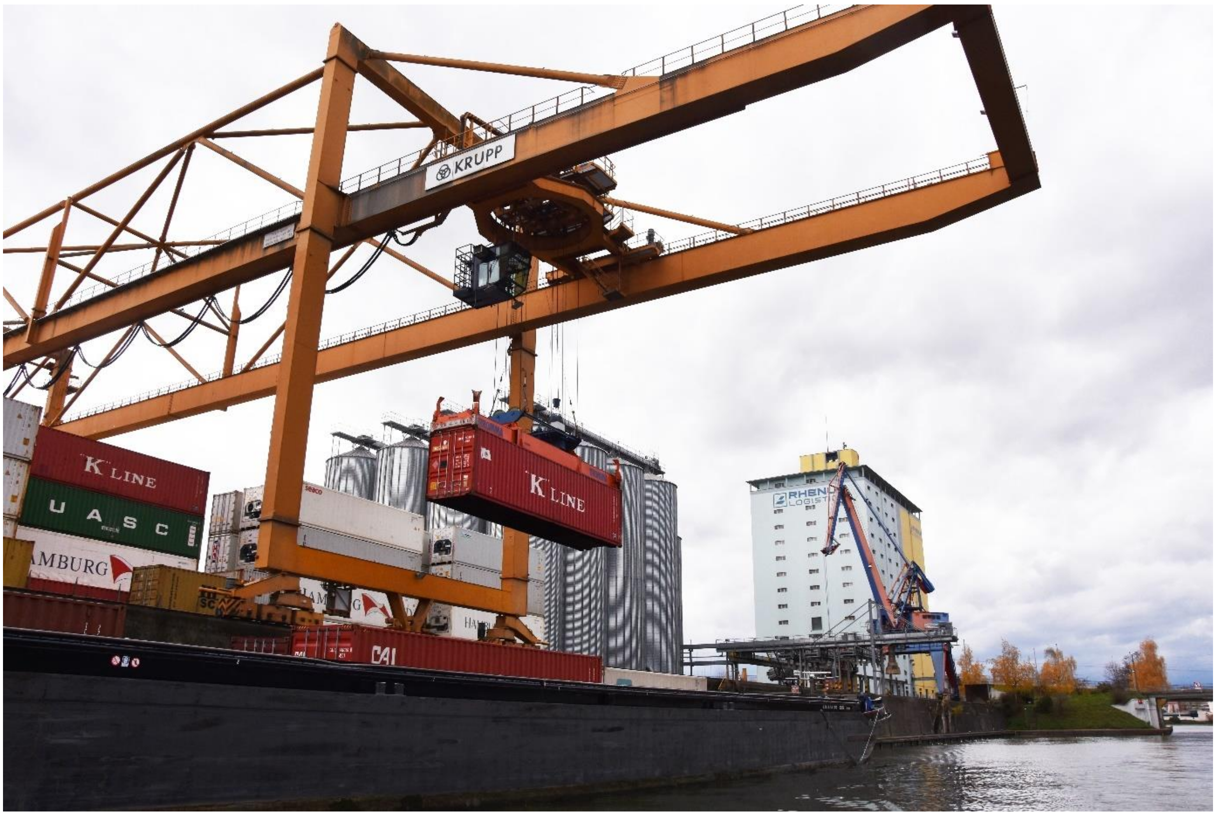
7.5.3 DXI's KV4.0 Data Hub

The start-up company DXI offers what it calls an open, integrated European data hub for combined transport based on the EDIGES messages.

KV4.0 Data Hub improves transparency and interoperability across the entire intermodal chain for bookings, timetables and shipment status based on the EDIGES data exchange format. It serves as a central distributor for all messages of the intermodal supply chain.



Containers and a Rhine barge in Contargo's terminal on the south side of Basel's Port Basin 2. The crane also serves railway tracks between the water and the container stacks. 18 November 2016. Photo George Raymond.

Complex intermodal supply chains

One of the biggest challenges of combined transport compared to other transport methods is its complexity. It involves:

- Many parties and data interfaces, including CT operators, traction providers (railway undertakings), terminals, companies providing first/last-mile trucking, and LSPs-
- The elaborate organization that combined transport requires.
- A corresponding, complex end-to-end information chain.

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- Connecting the stand-alone digital solutions of the parties involved.

The need to overcome this complexity has been clear for some time and led to the KV4.0 project.

2017-2020: the KV4.0 Project

KV4.0 Data Hub is the result of the KV4.0 Project implemented successfully in 2017-2020 and financed by the German ministry for innovation. Project partners included:

- Three logistic service providers: Hoyer (Germany), Paneuropa (Germany) and Bertschi (Switzerland).
- Two intermodal operators: Kombiverkehr (Germany) and Hupac (Switzerland).
- Three railway undertakings: DB Cargo (Germany), SBB Cargo International (Germany/Switzerland) and Lokomotion (Germany).
- Two intermodal terminals: KTL Ludwigshafen (Germany) and Hupac Busto (Italy/Switzerland).

Founded in 2022: The DXI company

The company DXI was formed in October 2022 to develop, commercialize and manage the KV4.0 Data Hub. DXI completed the production version of KV4.0 Data Hub in February 2023 and started commercial operation in March 2023.

Basis: EDIGES messages

The backbone of CT data message exchange via the KV4.0 Data Hub is the EDIGES format, which is TAF TSI compliant. The current format is EDIGES 4.1. It provides a uniform XML interface standard for message conformity validation and data exchange.

Support for CT participants and process steps

The main EDIGES messages (see section 7.2.1) correspond to standard processes in CT operations – be they offered on a terminal-to-terminal or door-to-door basis.

KV4.0 thus supports the following CT participants and process steps: consignor (dispatch), road carrier (first mile), outbound terminal/port, railway undertaking (train running, including gateway), shipping company (ocean transport), inbound terminal/port, road carrier (last mile), receiver.

The basic ingredients of KV4.0 are thus standards and collaboration among CT operators, terminals, railway undertakings and customers (typically LSPs).

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KV4.0 overcomes the complexity of intermodal supply chains by consolidating all data and making it available and usable for all authorized parties involved. It provides data transparency all the way from booking to the collection of the loading unit.

At the start of this process – the customer (typically an LSP) – places a booking with an CT operator. To support this step, DXI is now implementing the EDIGES messages providing operational timetables.

A combined-transport train hauls semi-trailers through the Basel SBB passenger station on 27 May 2018. Photo George Raymond.

ETA and ETP

KV4.0 transmits two particularly important pieces of information: Current estimated time of arrival (ETA) of the loading unit at its inbound terminal and current estimated time of availability for pickup (ETP) at that terminal for last-mile truck delivery to the customer.

Better planning of terminal slots and local trucking

At both the outbound and inbound terminal of a loading unit, the data carried by KV4.0 enables improved:

- allocation of truck arrivals and departures in the terminal.
- planning of terminal slots based on timely knowledge of planned shipments.

KV4.0 Data Hub technology

DXI calls KV4.0 is a modern, real-time, cloud-based solution. As a data hub, it is not a website, but rather a router that supports data exchange by means of a single interface. It

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offers both pull and push functions, but in all cases the sender alone decides who receives the data.

Current DXI priorities

DXI is currently concentrating on supporting the first users of the KV4.0 Data Hub and on promoting the hub to additional players among CT operators, terminals, railway undertakings and customers/LSPs.

A combined-transport train hauling blue semi-trailers has just crossed the Rhine in Basel. George Raymond took this photo from the Roche Tower on 9 October 2017.

7.6 Collaborative quality management system

An EDICT work package

Work Package 2 of the EDICT project is the specification of a common, collaborative quality management system (cQMS) for improvement of CT process efficiency and learning.

The call for a cQMS arose amidst the steady worsening CT train delay and cancellation rates of recent times.

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High-level objectives

The aim of cQMS is to provide a data collection and quality management system for CT. It seeks to get CT stakeholders out of the "blame game" and, by using a standardized, transparent and streamlined process, move toward better CT performance and especially better punctuality.

Involved stakeholders

cQMS involves CT stakeholders, including operators, terminals and railway undertakings, railway infrastructure managers and CT customers such as LSPs. It will be based on data coming directly from these partners or from CT data-exchange platforms like those in section 7.5.

Operations targeted

The focus of the cQMS will be scheduled, regularly running (in other words, non-*ad hoc*) CT rail operations as foreseen in Q-ELETA, the previous name of cQMS.

Harmonized delay/irregularity codes

The heart of the cQMS will be the development of standardized codes that specify the reason for a delay or cancellation. A two-level list of codes (category and sub-category) will be defined at train, wagon and LU level. These codes will be based on harmonized milestones in the CT production process, especially in CT terminals. This standardization effort will counteract the current uncoordinated development of "reason codes" by CT stakeholders.

Just as important as each standard reason code will be its definition. The goal is the make the process description, reason codes and definitions a European standard to eliminate discussion of what a code meant.

Streamlined and transparent code reconciliation and reporting

The cQMS work package within EDICT will define an efficient and transparent process for reconciling and reporting the new codes. This process should occur immediately and not for example two weeks later.

Data analysis and decisions on improvement measures

The next step in the process underlying the cQMS will be to output collected standard and reconciled codes for delays and cancellations to CT stakeholders in the form of regular and ad-hoc reports and a dashboard.

This will enable the stakeholders to perform traditional internal analyses but just as importantly to work together and, in a collaborative approach, analyse behaviour and causes and decide on and monitor quality improvement measures. They will also evaluate and continually improve the cQMS itself.

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The calendar for cQMS

The cQMS work package of EDICT is currently in progress and includes the following steps:

- Select a company to provide the cQMS process.
- Eight meetings to align different stakeholder's perspectives.
- Proposal of harmonized two-level reason codes list for delays and cancellations.
- IT and organizational implementation; test; pilot; assessment.
- Roll-out after July 2024.

8 Reports from major CT partner terminals

At the 10 May 2023 EDICT event in Munich, two important terminal clusters for European CT presented the integration of terminal-related data: the port of Rotterdam (section 8.1) and Antwerp's Combinant terminal (section 8.2).

Containers traversing the Dutch town of Blerick, approaching Venlo and the German border. 25 November 2019. Photo George Raymond.

8.1 Rotterdam's vision of terminal data integration

Gilbert Bal presented the Port of Rotterdam's current two-year "digital growth program" for rail, which is called *Basis Op Orde* or "basics in order".

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Why a digital growth program

The following circumstances gave rise to the *Basis Op Orde* program:

- Demand for rail freight is expected to grow via the Port of Rotterdam. Customers want rail instead of truck.
- The experience of market actors is that rail operations in the Port of Rotterdam are complex and inefficient. Information exchange between companies is still mainly manual. You may have to wait 15 minutes for someone to call you back with information you need. Market actors also see a lack of communication and cooperation within the rail chain. One possible explanation is a past focus on barge and truck as opposed to rail.
- The need for transparency and thus data exchange has finally now been accepted. Digitization is seen as critical to rail growth at the port. The market wants a solid basis for the exchange of rail-related data.
- The port's railway tracks are underused, so more efficiency is possible without laying more tracks.

Digital growth program *Basis Op Orde*

With financing from the Dutch government, the Port of Rotterdam is now conducting the two-year (2022-2023) *Basis Op Orde* digital growth program. Its aim to create a better digital basis for information exchange within the rail chain at the Port of Rotterdam

Twenty-five named parties from the rail sector are in the *Basis Op Orde* partnership. These include terminals, CT operators and railway undertakings. Gilbert Bal said that only a big port can bring all the rail operators together – they wouldn't do it themselves. He also said that 75% of rail operators are interested in joining.

Portbase, a digitization provider for Dutch ports, is developing some deliverables. An existing solution for barge transport is being extended to rail.

Mains goals in the first phase

The main goals in the first phase of *Basis Op Orde* are as follows:

- Digitalization for more transparency, better predictability, shorter waits and better capacity use.
- Creating a solid base for data exchange between parties.
- Share data seamlessly, add new data streams, digitalize core processes and reduce manual actions.

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Top priorities in the first phase

Here are the top functional priorities of *Basis Op Orde* in its first phase:

- Central request of terminal slots.
- Digital exchange on basis of train composition message.
- Digital exchange on terminal handling at container level.
- Availability of container status to operators and carriers.
- Notifications in case of exceptions concerning pre-notified containers and those currently being loaded/unloaded (including dangerous goods).

Follow-on steps

Once the first core processes have been digitized, the generated data can be analysed, including with “big data” techniques, to gain insights and identify improvements that will make the freight chain more efficient.

Top priorities for follow-on steps

The first phase of the *Basis Op Orde* digital growth program will lay the foundation for future improvements, including:

- Train ETA updates based on a connection to RailNetEurope’s TIS application.
- Digital checks of inbound and outbound wagons and the loading units they are carrying.
- Forecasts of what containers will be ready for terminal checkout when.
- Dynamic planning.

Benefits for stakeholders

The expected benefits of *Basis Op Orde* are better transparency, efficiency and resilience of the rail freight process and rail supply chain for each party involved in the Port of Rotterdam in the form of better cooperation and communication within the chain, optimal resource use, better predictability, lower costs, more transparency, less waiting time, less unused capacity and more customer value.

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BASF's combined-transport terminal in Ludwigshafen, Germany. The Rhine is nearby. 6 September 2018. Photo George Raymond.

8.2 Antwerp's Combinant terminal

Combinant nv calls itself the "open access" intermodal terminal in the port of Antwerp-Bruges. The chemical giant BASF was at the origin of the Comibinant facility, whose footprint now corresponds to 1200 football fields, or the size of downtown Antwerp.

A joint venture of BASF (45%), Hupac (35%) and Hoyer (20%) built and operates the facility, which contains private BASF rail shunting yards and sees 100 direct inbound or outbound CT trains per week.

The years around 2010 saw uncoordinated growth of EDI systems. Combinant forced all its customers to connect to the port of Antwerp's terminal operating systems.

Combinant involves all the actors in rail transport, including shippers, local trucking service providers, long-haul trucking companies, CT/intermodal operators, CT/intermodal terminals, railway undertakings, rail infrastructure managers, wagon keepers, ocean shipping lines, the port authority and the shunting yard.

Combinant has identified the need to design and offer a simple and cost-effective digital solution based on EDIGES messaging to integrate small and medium-sized sub-terminals into the Combinant data-sharing ecosystem. Some key features:

- Detailed entry and extra photos of trucks and wagon that customers can view on the Combinant website within 30 seconds.
- Real-time data exchange that is now 98% by EDIGES messages.
- Real-time graphical display of the terminal's layout.

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But Combinant customers still need an automated single window that provides all needed data. This solution will integrate the European TAF TSI standards for data exchange in rail freight.

9 Challenges in achieving visibility in European combined transport

We now turn to some questions and challenges that an SCVP may face in accessing CT data. We look at technical questions for the SCVP's integration of European CT data in section 9.1, changing attitudes on data sharing in section 9.2 and commercial obstacles to data access in section 9.3.

9.1 Technical questions for integration of European CT data

A hindrance on data sharing in CT can be the technical complexity, difficulty and expense of getting different IT systems to talk with each other, especially internationally. This section addresses the technical questions an SCVP needs to ask in considering how to integrate European CT in its supply-chain visibility services.

Mapping of DCSA and European CT data

As noted in section 7.2.4, an SCVP seeks to offer seamless visibility to customers involved in the shipment of containers worldwide. The customer now demands visibility over a container's whole journey between any two points in the world, including both sea and land legs. This means integrating data following DCSA maritime and European CT standards.

The terms, concepts and rules for in European CT data standard differ somewhat from DCSA's data standards. To provide seamless visibility, an SCVP needs a mapping between these standards.

Sources for CT data

A good starting place in an SCVP's search for a source of CT data is either the CESAR-NEXT or PXI's KV4.0 data platforms. Both these platforms use the EDIGES format that is now a standard for CT data exchange. How can these platforms and an SCVP collaborate?

Process for CT data access

What process does an SCVP need to follow in order to show CESAR-NEXT, PXI or RailNetEurope and their existing users that the provider is legitimately involved in a given CT shipment and thus is entitled to the information on the CT process pertaining to it?

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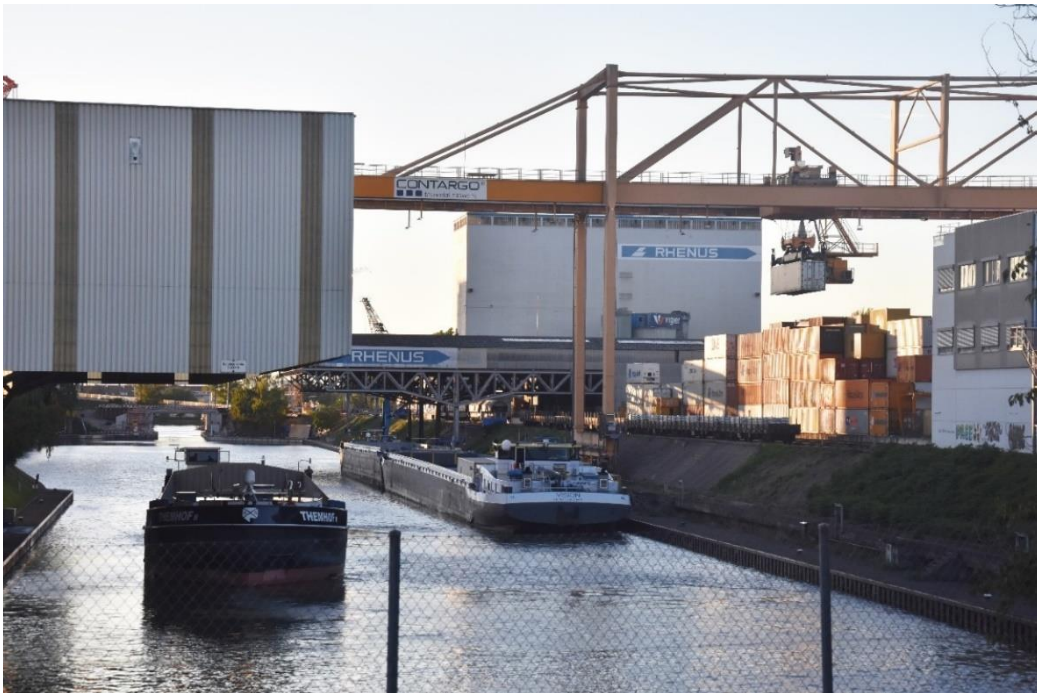

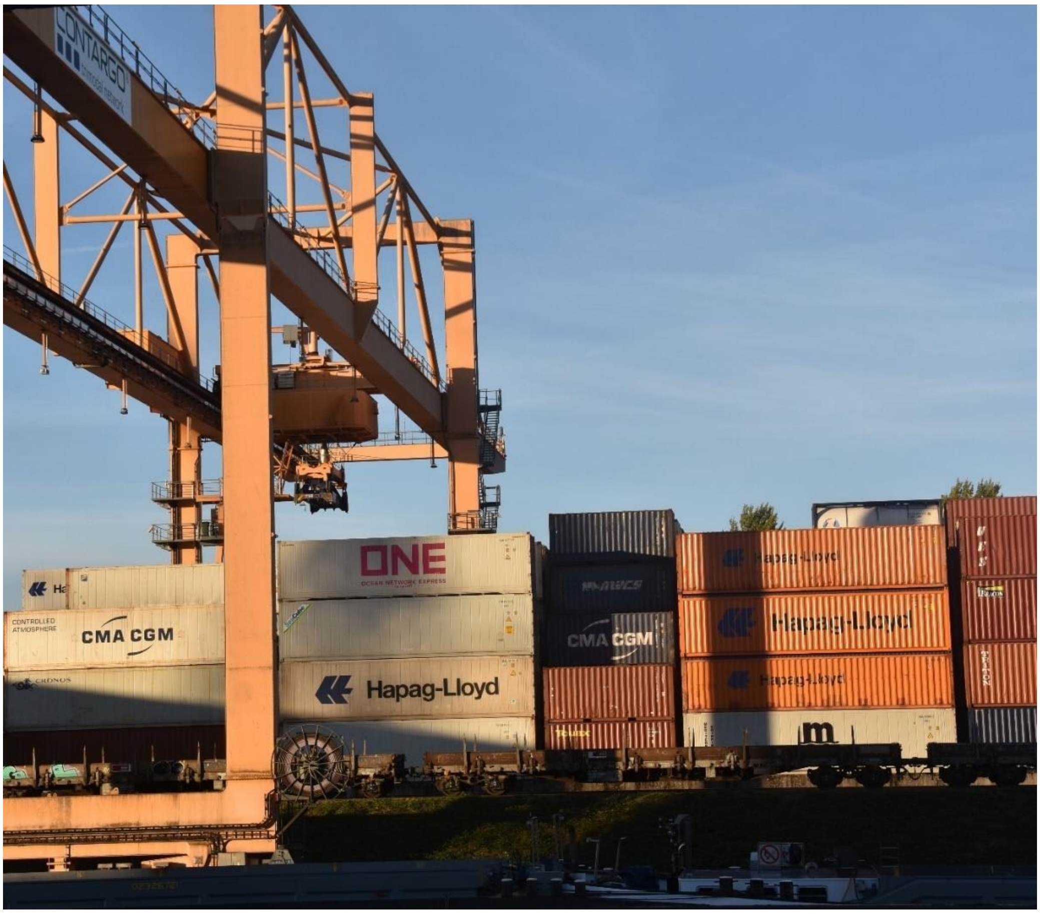

Across from the overhanging roof of the Ultra-Brag bulk handling facility, the Contargo terminal on the north side of Basel's Part Basin 2 transfers containers to Rhine barges. 19 September 2023. Photos George Raymond.

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Degree of coverage

If an SCVP were to start with a connection to CESAR-NEXT and/or KV4.0, what percentage of European CT traffic would this connection cover currently and how fast can this coverage by expected to grow in the near future? Also, do some CT operators and CT terminals only exchange a subset of the existing EDIGES messages? Why?

Every CT terminal is different

Great differences exist between CT terminals, both in terms of their size (for example, in number of loading units or trains handled per day) and nature (ranging from simple road/rail transhipment terminals to inland ports and seaports).

Another important difference is the country the terminal is located in, which may – even if most of the terminals are subject to or follow EU law – imply different regulations, data-protection policies and attitudes on data sharing. (See section 9.3 below.)

How can an SCVP deal with these differences?

Participating CT terminals and CT operators

To what degree are EDIGES (or TAF TSI) implemented for data exchange at the various CT terminals and CT operators? What are the differences between countries? Between terminals with different volumes of trains and types of loading units? Between (1) maritime ports, (2) inland waterway ports and (3) road-rail transshipment terminals with no waterway connection?

At what rate are CT terminals and CT operators (not all of whom are UIRR members) implementing the EDIGES messages and making their data available for exchange through CESAR-NEXT, KV4.0 some other multi-company platform or directly out of the terminal's or CT operator's own IT system? In this case, do they use the EDIGES messages, TAF TSI, the pan-modal eFTI messages, DCSA or another format?

Intermediaries

SCVPs may seek information on shipments from intermediaries in the CT ecosystem. Such intermediaries may get their information more or less directly from CT operators, CT terminals or their rail-sector partner. When such information is second- or third-hand, it may be less timely or accurate in some cases. How can improvements be achieved?

Alternatives

What are the alternatives to data exchange with CESAR-NEXT or KV4.0? In some cases, could a direct connection with RailNetEurope's Train Information System be interesting, if only as a second source to confirm or serve as a backup for train-related data?

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Position reporting

Would it be useful to connect, where possible, directly to GPS location data for trains, wagons and loading units? To what degree has GPS-based position reporting in combined transport coalesced into a set of major players from whom an SCVP can obtain position data for a significant portion of European loading units and wagons?

Such exchange can be a challenge because the GPS units typically belong to the owner of the equipment (locomotive, wagon, intermodal loading unit), whose link to the shipper of a loading unit is indirect and ephemeral.

To what degree does data provided by CT operators via EDIGES messages now integrate GPS-based position reporting?

Data quality, especially for ETA/ETP

What differences exist in the quality of data concerning for example current location and ETA/ETP provided by the different CT operators, CT terminals and national rail infrastructure managers?

To what degree does updated schedule information available from CT operators currently reflect ETA/ETP? To what degree could the visibility offered by an SCVP be enhanced by directly using the outputs of AI-based ETA estimators? What market leaders, if any, are emerging in this area?

Intermodal train in Tbilisi, capital of Georgia. 6 July 2019. Photo Pierre-Noël Rietsch.

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A geographical starting place

Another question is, where in Europe should the SCVP start its CT data coverage?

The EU has structured the European rail network into rail freight corridors (RFCs). The corridors reflect dominant traffic flows. Each corridor has a (somewhat skeletal) management that is supposed to (and increasingly does) coordinate the national IMs along the corridor on issues such as train path management and infrastructure investments. An interactive version of the current European corridor map can be found here (under the Rail Freight Corridors tab).

Any roll-out of visibility services in CT seems best based on the services' successive extension to different rail RFCs. It may make sense, for example, for an SCVP to start with CT operators whose operations focus on RFC1, the main spinal north-south corridor through western Europe (via Basel!) with the most rail traffic of all the RFCs.

Data sharing is technically ever easier

As this report shows, combined transport is a complex business involving a variety of actors and data types. However, every piece of relevant data is known to someone and almost all of it has now been digitalized somewhere. And the technologies for collecting and sharing this data are ever better.

Business case

Finally, do the fees for data feeds with one or more of these sources allow an SCVP to make a business case for subscribing to the feed with the intention of forwarding this same data to its customers as part of its supply-chain visibility services?

9.2 Changing attitudes on data sharing

As they first developed in the 19th century, the only organizational model for railways was the army. Each European railway was a national monopoly with a single-country focus. Each railway was vertically integrated, i.e. ran both the infrastructure and the trains.

In the last decades of the 20th century, this lack of competition and their status as state organizations left European railways with a culture of relatively open information access.

Growth of competition and a culture of secrecy

In the 21st century, however, the legal separation of train and rail infrastructure operators in Europe and the opening of access to the tracks of the former monopoly railways to new entrants exposed the train operators to competition. Railway *infrastructure managers* aren't in direct competition with each other, but their customers – the *railway undertakings* who run the trains – are, and this had made even the IMs more concerned about data confidentiality. Contractual and legal stipulations came to support this.

In this context, retention of information could also result from fear of being blamed or having a weaker position in commercial and legal disputes.

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Recognition of the importance of data sharing

At the same time, the internet has accustomed everyone to direct access to information without waiting for a reply to a phone call. The stakeholders in the CT sector seem to now recognize the importance of data access to operational partners and customers and are increasingly desirous to make it available.

9.3 Commercial obstacles to data access

Despite the general loosening of attitudes and restrictions on data sharing the CT sector, SCVPs have complained about the commercial – as opposed to technical – obstacles they have met in accessing data in combined transport.

Authorized personnel only. Fence marking the border zone between Switzerland (non-EU) and Germany (EU) in Basel. The north-south motorway is overhead. Container trains for Switzerland leaving Basel’s Kleinhüningen port district traverse a section of Deutsche Bahn infrastructure that includes Basel’s Badischer passenger station. 19 September 2023. Photo George Raymond.

Complaints about CT data suppliers

Here are some examples of SCVPs’ complaints about CT data suppliers:

- Although an SCVP may represent the shipper who is ultimately paying for a shipment, a CT or rail-sector operator may balk at sharing data on the shipment because the SCVP is not a direct customer of the operator. In some cases, the operator may only give data to the customer who directly ordered services from the operator. It can’t or won’t give the data to anyone else, even if the direct customer asks them to.

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- Data on an international CT train may considered the property of each IM it traverses. Despite international RFC management, the SCVP must apply to each IM along the train's route for its part of the train's data.

- Some CT operators send emails to customers if something goes wrong with a shipment, but this is not always the case.

Building an overview

As we saw in the introduction, a CT shipment often relies on multiple operators of trains, terminals and rail infrastructure. These parties often do not always share the same perceptions and policies on passing shipment information to SCVPs.

This means that SCVPs lack a consistent way to engage with CT and rail-sector operators to get data. An SCVP needs to understand the data-sharing policy of these operators. The following organizations can provide first answers:

- The International Union of Road-Rail Combined Transport (UIRR), who can provide an overview of its members' policies – and challenges.

- Multi-operator data providers such as CESAR Information System (CIS), DXI and RailNetEurope.

- The major CT operators who own CIS and/or DXI, including Hupac (Switzerland), Kombiverkehr (Germany), Mercitalia Intermodal (Italy) and Novatrans (France).

As a basis for a dialogue with the European CT sector, an SCVP – or a group of SCVPs – could document commercial obstacles to CT data access as follows:

- Examples in European CT where an SCVP cannot easily access data even though an SCVP's customer is a legitimate interested party in a shipment.

- Analogous examples in ocean, air or truck transport (and rail transport in North America) where corresponding data access mechanisms exist.

- Description of obstacles to data access that existed in these sectors in the past and how were they eliminated.

- Aspects of the European CT sector's data-sharing practice (sector-wide or at specific operators) that are unreasonably restrictive and thus counter-productive in terms of customer service compared with industry practice in other modes or at other operators.

10 Conclusion

This report has presented the issues facing SCVPs in their strategic effort to integrate European CT within the information they offer on the location, status and expected event timings of their customers' shipments.

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We started with a catalogue of key actors and concepts, the current performance of CT and its role in meeting EU energy and decarbonization goals. We saw the relative complexity of CT and that the number and variety of involved actors creates unique information needs. The CT sector is responding to these needs with standardized data exchange formats and processes, information coding and reference databases. We examined the experience of the port of Rotterdam and a major terminal in Antwerp in developing and promoting the digitization of CT and the rail operations on which it relies.

The report closed with questions that SCVPs need to ask and challenges they may face when integrating European CT within their offerings. These challenges are technical but especially commercial, as they reflect varying perceptions and policies among involved operators on sharing data with SCVPs.

11 About the author

George Raymond has extensive experience and knowledge in logistics and rail (see www.railweb.ch).

Major career steps: A French national, he grew up and attended university in the US. Some major steps in his career:

- Master's thesis at MIT on management of rail freight classification yards in Massachusetts and eastern France.
- Logistics at Renault Automobiles in France.
- Rail operations planning at Swiss Federal Institute of Technology (EPFL) in Lausanne and at French National Railway's freight division.
- IT for order processing in international transport (air, ocean, trucking) at Danzas in Basel.
- Since 2002: independent consulting for the railway sector.

Major projects: Some of his major rail freight projects include:

- Studies on European intermodal services for French and Adriatic ports and a Rotterdam-based deep-sea shipping company.
- IT systems for rail freight, including introduction of a US company's software at French National Railways and a German company's software at non-SNCF French rail freight operators.
- Data exchange in rail freight for French, German and Swiss railways based on the European TAF TSI standards.
- For a European port, strategic study of technologies for rail transport of truck trailers, including:
    - Vertical loading of non-cranable trailers (some 90% of European fleet).
    - Fast horizontal loading of all trailers.

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George Raymond just outside the east portal of the 10-kilometer Moffat Tunnel in Colorado, USA, July 1968. Photo George Raymond Sr.

Recent publications: George Raymond recently published the following articles:

- An activist in European rail freight (May 2023)
- French rail freight: what progress in 12 months? (November 2022)
- Rail freight from Europe to China and back: brakes and potential (51-page report, October 2021)
- More chemicals on the rails to China? (October 2021)
- Getting freight to change trains like passengers do
- Is this rail's decade on the Silk Road?
- Consolidating control in the Port of Switzerland
- Rail freight: Is France waking up?
- French rail freight: Act locally, but know the bigger picture

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- A quantum step for freight in the Basel area
- Finally: a wagon to carry standard semi-trailers throughout Europe

George Raymond, Basel, 8 September 2021. Photo Maryvonne Chartier-Raymond.

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